Enbridge Line 6B MP 608

Marshall, MI Pipeline Release

Case No.: 15-1411-CE

Report of Findings
Large Woody Debris Freshwater Mussel
Survey & Relocation

Prepared for Michigan Department of Environmental Quality

Enbridge Energy, Limited Partnership

Submitted: September 23, 2016

Document ID 5353

Table of Contents

LIST OF ACRONYMS

ADI	Areas of Direct Impact
EI	Environmental Inspector
Enbridge	Enbridge Energy, Limited Partnership
Freshwater Mussel SOP	*Standard Operating Procedure for Conducting Freshwater Mussel Surveys and Relocations Within Work Segments of the Kalamazoo River*, submitted to the MDEQ on September 8, 2016.
ft	feet
LDB	left descending bank
LWD	large woody debris
MDEQ	Michigan Department of Environmental Quality
m	meter
MP	Mile Post
RDB	right descending bank

1.0 Introduction

Enbridge Energy, Limited Partnership (Enbridge) along with a contractor specializing in freshwater mussel surveys prepared an approach to conduct freshwater mussel surveys and subsequent relocation at riffles, identified within large woody debris (LWD) work sites of the Kalamazoo River, that may be unavoidable for heavy equipment used to install LWD. This approach is detailed in the approved *Freshwater Mussel Evaluation & Management Plan Supplement to Large Woody Debris Installation Plan*, submitted to the Michigan Department of Environmental Quality (MDEQ) on September 8, 2016 (Enbridge, 2016a).

1.1 Objectives

The purpose of these freshwater mussel surveys was to identify and relocate freshwater mussels within riffles that may be disturbed by heavy equipment travel to complete LWD installation on the Kalamazoo River. The following sections outline freshwater mussel survey locations, methodology, and results of survey and relocation of freshwater mussels.

2.0 Freshwater Mussel Surveys

2.1 Survey Locations

The freshwater mussel surveys were conducted within riffles identified in the approved *Report of Findings: Large Woody Debris Riffle Survey*, submitted to the MDEQ on September 8, 2016 (Enbridge, 2016b), that may be unavoidable from disturbance with heavy equipment used to install LWD. Specifically, mussel surveys were conducted at the following riffle locations:

- Polygon 34.50-R2,
- Polygon 34.50-R1, and
- Polygon 34.75-R1.

2.2 Methodology

Freshwater mussel surveys, relocation, and associated mapping were conducted on September 6 and September 7, 2016, in accordance with the approved *Standard Operating Procedure for Conducting Freshwater Mussel Surveys and Relocations Within Work Segments of the Kalamazoo River,* submitted to the MDEQ on September 8, 2016 (Enbridge, 2016c) (Freshwater Mussel SOP) included in *Attachment A*. In brief, this procedure included identifying and demarcating freshwater mussel survey areas, documenting freshwater mussels if present within each survey area, and relocating mussels within the existing riffle habitat outside of potential heavy equipment travel routes.

On September 6, 2016, four technical staff representing Enbridge, inclusive of two aquatic biologists, a wetland scientist, and a stream morphologist conducted freshwater mussel surveys at riffle polygons 34.50-R1 and 34.75-R1 (also referenced as Survey Areas 2 and 3, respectively). Enbridge technical staff was accompanied by an Enbridge Environmental Inspector (EI) and a MDEQ representative. On September 7, 2016, this same team, with the exception of the MDEQ representative, conducted the remaining freshwater mussel survey at riffle polygon 34.50-R2 (also referenced as Survey Area 1).

General field methods included launching from the closest boat launch site along the Kalamazoo River and boating to the downstream end of the riffle polygon. The procedure included surveying for freshwater mussels within in Areas of Direct Impact (ADI), defined herein as areas within identified riffles where heavy equipment travel is proposed. In addition, a 2-meter (m) lateral and 10-m longitudinal buffer zone was surveyed to the left and right, and

downstream and upstream of the ADI, respectively. The ADI and buffer zones were surveyed in subsections no greater than 100 square meters for a minimum of 20 minutes per subsection without the use of transects. Freshwater mussel survey areas were marked with floating buoys and surveys began from the downstream end of the riffle working upstream. Where conditions allowed, a viewing bucket was utilized to locate mussels from the water surface. However, in areas where mussels could not be located from the water surface, field staff utilized snorkeling equipment to dive down and survey the river bottom before resurfacing. Field staff continued this method noting the previous area surveyed and diving down to an adjacent location to survey the river bottom.

After completing the survey for each subsection, mussels encountered were identified to species level, enumerated, photographed (at least once per species), and temporarily stored in submerged mesh bags. Mussels were then relocated outside of the ADI and buffer zones into suitable habitat within the same riffle complex. Mussels were positioned in the substrate with their anterior end down, allowing for normal function of posterior end siphons.

During the field investigation, approximate freshwater mussel survey areas, freshwater mussel relocation areas, and areas available for heavy equipment travel were recorded in the Trimble® Yuma (Yuma) (*Figure 1, Sheet 1* and *Sheet 2*). Photographs collected of each mussel species, along with additional photographs portraying general survey methods, are provided in *Attachment B*.

3.0 Freshwater Mussel Survey Results

Included as part of this report, *Figure 1* depicts the location of previously mapped riffles, freshwater mussel survey areas, freshwater mussel relocation areas, and areas available for heavy equipment travel collected on September 6 and September 7, 2016 within the three riffle polygons identified in *Section 2.1*. In addition, *Table 1* summarizes the field data collected on these dates for all survey areas. The following provides a summary of field activities in each survey area by the field team.

3.1 Survey Area 1 – Riffle Polygon 34.50-R2

Prior to initiating field activities in Survey Area 1, the field team observed poor mussel habitat, water depths greater than 4.0 feet (ft), and water velocities that were potentially harmful to worker safety within the buffer zones downstream of the ADI. After conferring with the Enbridge EI and MDEQ representative in the field, the team agreed to adjust the downstream buffer zone in order to conduct the survey in areas with higher quality mussel habitat in a safe manner. In the buffer zones upstream of the ADI, the field team also observed water depths greater than 4.0 ft. However, this area did not pose a safety concern due to large boulders in the riffle impounded water that reduced water velocity. This site reconnaissance occurred near the end of the field day on September 6, 2016. Collectively, the team agreed to halt field work until the following day to better prepare for these site conditions.

On September 7, 2016, the freshwater mussel survey of riffle polygon 34.50-R2, Survey Area 1, was completed. Survey Area 1 was divided into six subsections identified as A through F. Survey Area 1 was the smallest of the three riffle polygons surveyed and yielded the lowest quantity of observed mussels. Field methods included the use of a viewing bucket and snorkeling techniques. Within surveyed buffer zones, water depths exceeded 4.0 ft, making it necessary to dive to the river bottom to observe and collect mussels.

Within the survey area, the majority of the mussels were collected in the buffer zones, with only one mussel collected in the ADI. As detailed in *Table 1*, total survey time was 179 minutes resulting in the collection of 60 mussels comprised of four different species. The mucket *(Actinonaias ligamentina)* was the most collected species, followed by the Wabash pigtoe *(Fusconaia flava),* spike *(Elliptio dilatata),* and plain pocketbook *(Lampsilis cardium)*. One mussel could not be confidently identified in the field, but was later confirmed as a spike *(Elliptio dilatata)* after conferring with other mussel experts and reviewing multiple close-up

photographs and measurements of the individual. All mussels were identified and relocated outside of the ADI and buffer zones. Given that a majority of mussels were identified in deeper water at this survey area, the relocation area extended upstream of the previously mapped riffle polygon (*Figure 1, Sheet 1*).

During the survey, field staff noted an additional area for heavy equipment travel between the right descending bank (RDB) and the ADI. After conferring with the Enbridge EI, the field team agreed to revise and move the travel route for heavy equipment closer to the RDB and therefore impact a smaller area of the ADI. This revised travel route is depicted in *Figure 1, Sheet 1.*

3.2 Survey Area 2 – Riffle Polygon 34.50-R1

On September 6, 2016, a freshwater mussel survey of riffle polygon 34.50-R1, Survey Area 2, was completed. Survey Area 2 was divided into nine subsections identified as A through I. Within select subsections, specifically subsections C, D, E, and F, pockets of dense vegetation beds existed, obscuring visibility in these areas. It was noted that mussel populations decreased in pockets of dense vegetation as compared to areas with less vegetation.

This survey area was the largest of the three riffle polygons surveyed and contained the largest quantity of collected mussels. *Table 1* details a total of 243 mussels were collected during the survey time of 320 minutes. There were six different species of mussels collected within the survey area with the majority identified as muckets *(Actinonaias ligamentina*), followed by plain pocketbooks *(Lampsilis cardium)* and Wabash pigtoes *(Fusconaia flava).* Less than 10 of each of the following species were also identified within this survey area: spike *(Elliptio dilatata),* fatmucket *(Lampsilis siliquoidea),* and creeper *(Strophitus undulatus).*

Freshwater mussels were relocated following identification. These mussels were relocated from the ADI and buffer zones to approximately the left downstream half of the mapped riffle polygon. Mussels were relocated within the same longitude to the extent practicable and within the same riffle polygon (*Figure 1, Sheet 1*).

3.3 Survey Area 3 – Riffle Polygon 34.75-R1

On September 6, 2016, field teams completed freshwater mussel survey of riffle polygon 34.75-R1, Survey Area 3, following the completion of Survey Area 2. A total of five subsections were surveyed identified as A through E.

Survey Area 3 was the second largest survey area and also yielded the second largest quantity of freshwater mussels. *Table 1* details a total of 79 mussels collected over the course of 156 minutes. There were five different mussel species collected, with the large majority identified as muckets *(Actinonaias ligamentina),* and less than five from each of the following species: spike *(Elliptio dilatata),* plain pocketbook *(Lampsilis cardium),* fluted-shell *(Lasmigona costata),* and creeper *(Strophitus undulatus).*

Freshwater mussels were relocated following identification. These mussels were relocated from the ADI and buffer zones to approximately the middle of the mapped riffle polygon. Mussels were relocated within the same latitude to the extent practicable and within the same riffle polygon (*Figure 1, Sheet 2*).

During the survey, field staff noted an area for heavy equipment travel between the left descending bank (LDB) and the ADI. After conferring with the Enbridge EI, the field team agreed to revise the travel route for heavy equipment closer to the LDB, therefore impacting a smaller area of the ADI. This revised travel route is depicted in *Figure 1, Sheet 2.*

4.0 Summary

Freshwater mussel surveys and associated relocation activities on and adjacent to, three previously mapped riffle polygons from Mile Post (MP) 34.50 - MP 34.75 were completed in accordance with the Freshwater Mussel SOP included in *Attachment A*. The freshwater mussel survey areas, freshwater mussel relocation areas, and areas available for heavy equipment travel are depicted in *Figure 1, Sheet 1* and *Sheet 2*. Freshwater mussel relocation polygons will be marked by the Enbridge EI with rope buoys prior to LWD installation activities and monitored during heavy equipment travel through these areas.

A total of 382 freshwater mussels were collected, identified, and relocated during this effort. A total of four species, mucket *(Actinonaias ligamentina)*, plain pocketbook *(Lampsilis cardium)*, spike *(Elliptio dilatata)*, and Wabash pigtoe *(Fusconaia flava)* were identified throughout all surveyed areas. Additionally, two species, the creeper *(Strophitus undulatus)* and fatmucket *(Lampsilis siliquoidea),* were only identified in two of the surveyed areas and one fluted-shell *(Lasmigona costata)* was collected in Survey Area 3. Muckets *(Actinonaias ligamentina)*, comprised nearly 83% of the total, with 317 collected. The Wabash pigtoe *(Fusconaia flava)* was the second highest quantity at 28 (approximately 7% of the total). Other mussel species comprised less than 5% of the total collected. No state- or federally-listed mussel species were observed at any time during the survey.

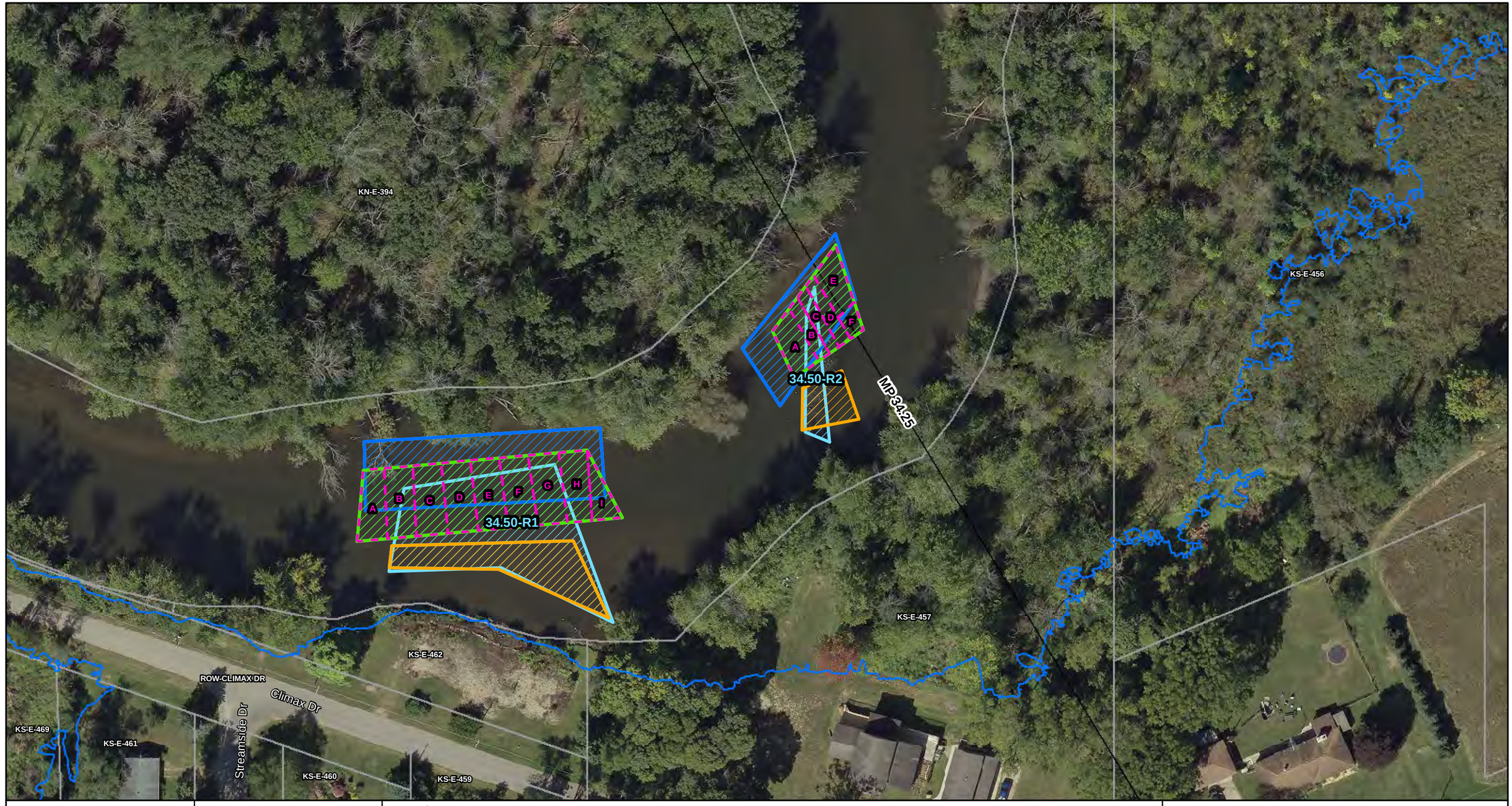
5.0 References

Enbridge, 2016a. Enbridge Energy, Limited Partnership Line 6B MP 608 Pipeline Release, Marshall, Michigan; *Freshwater Mussel Evaluation & Management Plan Supplement to Large Woody Debris Installation Plan,* dated September 8, 2016.

Enbridge, 2016b. Enbridge Energy, Limited Partnership Line 6B MP 608 Pipeline Release, Marshall, Michigan; *Report of Findings: Large Woody Debris Riffle Survey*, dated September 8, 2016.

Enbridge, 2016c. Enbridge Energy, Limited Partnership Line 6B MP 608 Pipeline Release, Marshall, Michigan; *Standard Operating Procedure for Conducting Freshwater Mussel Surveys and Relocations Within Work Segments of the Kalamazoo River,* dated September 8, 2016.

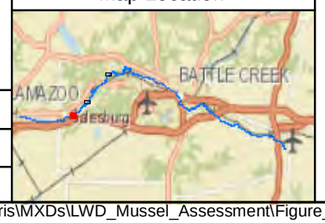
Figure



ENBRIDGE

Drawn:	EN	9/20/2016
Approved:	LN	9/20/2016
Project #:	60481718	

Map Location



Legend

- Mussel Relocation Area
- Mussel Survey Area
- Area Available for Heavy Equipment Travel
- Approximate Riffle Boundary
- Approximate Mussel Survey Subsection
- Parcel
- Quarter Mile Grid Segments
- Kalamazoo River Flood Inundation Boundary

N

0 35 70 140

Scale in Feet

FIGURE 1
LARGE WOODY DEBRIS - FRESHWATER MUSSEL SURVEY & RELOCATION
SHEET 1 OF 2

ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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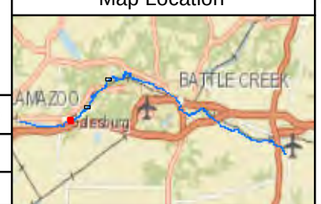
Aerial Photography Date: September 2015

ENBRIDGE

Drawn:	EN	9/20/2016
Approved:	LN	9/20/2016
Project #:	60481718	

Map Location



Legend

- Mussel Relocation Area
- Mussel Survey Area
- Area Available for Heavy Equipment Travel
- Approximate Riffle Boundary
- Approximate Mussel Survey Subsection
- Parcel
- Quarter Mile Grid Segments
- Kalamazoo River Flood Inundation Boundary

N

0 35 70 140

Scale in Feet

FIGURE 1
LARGE WOODY DEBRIS - FRESHWATER MUSSEL SURVEY & RELOCATION
SHEET 2 OF 2

ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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Aerial Photography Date: September 2015

Table

Table 1. Freshwater Mussel Survey Field Data
Enbridge Line 6B MP 608, Marshall, MI Pipeline Release
Enbridge Energy, Limited Partnership

Survey Location	Survey Area	Approximate Survey Area (square meters)	Survey Time (minutes)	Mucket (*Actinonaias ligamentina*)	Wabash pigtoe (*Fusconaia flava*)	Plain pocketbook (*Lampsilis cardium*)	Spike (*Elliptio dilatata*)	Creeper (*Strophitus undulatus*)	Fatmucket (*Lampsilis siliquoidea*)	Fluted-shell (*Lasmigona costata*)	Total Mussels Collected and Relocated
34.50-R2	Subsection A	100	28								0
34.50-R2	Subsection B	50	24	1							1
34.50-R2	Subsection C	75	24								0
34.50-R2	Subsection D	50	40	12	2	1					15
34.50-R2	Subsection E	75	40	13	3	1	3				20
34.50-R2	Subsection F	50	23	12	11		1				24
SURVEY AREA 1 TOTAL		**400**	**179**	**38**	**16**	**2**	**4**	**0**	**0**	**0**	**60**
34.50-R1	Subsection A	100	32	12	3		1		2		18
34.50-R1	Subsection B	100	48	4	2	1	1				8
34.50-R1	Subsection C	100	35	15	2	2	1				20
34.50-R1	Subsection D	100	35	23		1	1				25
34.50-R1	Subsection E	100	35	28	1	1	1				31
34.50-R1	Subsection F	100	35	24		1	1				26
34.50-R1	Subsection G	100	35	35	4	3	1				43
34.50-R1	Subsection H	100	35	46		3		1			50
34.50-R1	Subsection I	75	30	21		1					22
SURVEY AREA 2 TOTAL		**875**	**320**	**208**	**12**	**13**	**7**	**1**	**2**	**0**	**243**
34.75-R1	Subsection A	50	25	6			1			1	8
34.75-R1	Subsection B	100	35	26		1		1			28
34.75-R1	Subsection C	100	30	15			3				18
34.75-R1	Subsection D	100	30	14							14
34.75-R1	Subsection E	100	36	10		1					11
SURVEY AREA 3 TOTAL		**450**	**156**	**71**	**0**	**2**	**4**	**1**	**0**	**1**	**79**
ALL SURVEY AREAS TOTAL		**1725**	**655**	**317**	**28**	**17**	**15**	**2**	**2**	**1**	**382**

Attachment A

Standard Operating Procedure

Approved

Enbridge Line 6B MP 608

Marshall, MI Pipeline Release

Case No.: 15-1411-CE

Standard Operating Procedure for Conducting Freshwater Mussel Surveys and Relocations Within Work Segments of the Kalamazoo River

Prepared for Michigan Department of Environmental Quality

Enbridge Energy, Limited Partnership

Submitted: August 3, 2016

Approved: September 8, 2016

(MDEQ Approval: August 23, 2016)

Document ID 5338

Approved

Table of Contents

Approved

LIST OF ACRONYMS

ADI	Area of Direct Impact (ADI)
LWD	large woody debris
MDNR	Michigan Department of Natural Resources
ODNR	Ohio Department of Natural Resources
T&E	Threatened and Endangered Species
WVDNR	West Virginia Department of Natural Resources

1.0 BACKGROUND

Prior to conducting freshwater mussel surveys or relocations, a Scientific Collectors Permit is required and will be secured from the Michigan Department of Natural Resources (MDNR) for the handling or relocation of any non-listed mussel species (neither listed as endangered, threatened, nor of special concern). Proposed mussel surveys for work segments of the Kalamazoo River will encounter non-listed species based upon an October 2010 Mussel Shell Survey Report (Badra, 2011) which documented the presence of live mussels (non-listed) in various reaches of the Kalamazoo River.

In the unlikely event state-listed species are encountered (i.e. species listed as endangered, threatened, or of special concern), a MDNR Threatened and Endangered Species (T&E) Permit will be secured as a precaution.

To date, the MDNR has yet to establish their own freshwater mussel protocols for the survey and relocation of mussels within Michigan's streams or rivers. The MDNR has been utilizing protocols established by the West Virginia Department of Natural Resources (WVDNR) and more recently, the Ohio Department of Natural Resources (ODNR). The ODNR has adapted their protocols from the WVDNR protocols to account for more northern climates and conditions more indicative of the Great Lakes (ODNR, 2016). In light of the fact that future MDNR mussel survey and relocation methodologies will apparently be aligned closely with ODNR protocols, proposed Standard Operating Protocols for conducting the large woody debris (LWD) installation freshwater mussel survey and relocation will utilize the ODNR protocols unless otherwise provided in the field protocols below to account for the type of activities being proposed throughout the work segments.

2.0 FIELD PROTOCOL

Areas documented as riffles along LWD installation heavy equipment access routes that cannot be avoided will be surveyed, and any mussels that are found will be relocated in accordance with the ODNR protocols (ODNR, 2016). In addition to the defined Area of Direct Impact (ADI), 10-meter upstream and downstream buffers will also be surveyed and mussels relocated as listed in Appendix G of the *Ohio Mussel Survey Protocol* (ODNR, 2016). Using Appendix G, the proposed placement of LWD best fits the category of "shoreline protection" in that table, which recommends buffer distances of 10 meters

upstream and 10 meters downstream of the ADI. Based upon the relatively narrow width of the ADI, the lateral buffer of 10 meters recommended for mussel survey and relocation will be reduced to 2 meters given the precision to which equipment is expected to navigate through these proposed impact areas. The lateral buffer shall be on both sides of the ADI and may only be on one side if the ADI abuts the river bank.

Transects will not be used; instead the entire ADI, upstream, downstream, and lateral buffer areas will be surveyed, and all mussels encountered will be identified to the species level and relocated outside of the ADI and its associated buffer areas.

The following briefly summarizes portions of the Ohio Mussel Survey Protocol (ODNR, 2016) and past approved MDNR mussel protocols that will be utilized:

1. Visual or surface searches of the bottom substrates for mussels will be conducted of the entire ADI, including buffer areas. Each of these areas shall be subdivided into smaller areas or cells, not exceeding 100 square meters (m^2) in size, to assist in conducting systematic searches of each area or cell, to ensure that all areas are surveyed. This includes moving cobble and woody debris; hand sweeping away silt, sand, and/or small detritus; and disturbing/probing the upper 5 centimeter (2 inches) of substrate in order to better view or feel the mussels which may be present. A minimum rate of 20 minutes per 100 m^2 of visual searching shall be expended in each segment of heterogeneous substrate within each cell.
2. If any state-listed mussels are found, an additional 30 minutes of visual searching shall be expended within that existing 100 m^2 area along with any adjoining upstream, downstream and laterally abutting 100 m^2 areas or cells.
3. Visual searches will commence at the downstream end and work upstream.
4. All mussels encountered will be identified to species, enumerated, photographed (at least once per species), temporarily stored in submerged mesh bags, and then moved to a predetermined Relocation Area. The Relocation Areas consist of undisturbed riffle habitat outside of the ADI and 2-meter lateral buffer area within the same riffle complex containing the same or similar suitable habitat. Mussels will therefore be relocated a short distance and remain within their same riffle complex, where other mussels are also presumably present.. Mussels shall be inserted posterior end up and their location, either individually or in groups, will be mapped using a global positioning system unit capable of sub-meter accuracy.

5. Once the ADI and lateral buffer have been surveyed and mussels have been relocated, physical markers will be installed within the Kalamazoo River that clearly demarcate where mussel relocations have been conducted and the area in which LWD installation equipment can travel.
6. A mussel survey and relocation summary report will be prepared upon completion of the relocation effort. Information on the species and number of mussels encountered and relocated from the ADI and buffer zones shall be provided to the MDNR and/or other regulatory agencies requesting said survey/relocation work.

3.0 LITERATURE CITED

Badra, 2011. Badra, Peter. *Mussel Shell Survey Report: Kalamazoo River Unionid Mussel Shell Survey in the Marshall and Battle Creek Area*, October 2010. Prepared for Stephanie Milsap, U.S. Fish and Wildlife Service and Kalamazoo River Enbridge Line 6B Oil Spill Trustee Council. July 20, 2011.

ODNR. 2016. Ohio Department of Natural Resources, Division of Wildlife and U.S. Fish and Wildlife Service, Ohio Ecological Services Field Office; *Ohio Mussel Survey Protocol*. April 2016.

Attachment B

Photographic Log

Photo 1. Upstream buoy placement in Survey Area 1: 34.50-R2 (September, 2016).

Photo 2. Looking downstream through Survey Area 2: 34.50-R1.
Note downstream buoys marking survey area near deadfall on right bank. (September, 2016).

Photo 3. Looking upstream at Survey Area 3: 34.75-R1.
Note buoys in all four corners of survey area (September, 2016).

Photo 4. Typical snorkeling mussel collection technique (September, 2016).

Photo 5. Typical viewing bucket mussel collection technique (September, 2016).

Photo 6. Mucket *(Actinonaias ligamentina*), plain pocketbook *(Lampsilis cardium)* , and creeper *(Strophitus undulatus)* mussels collected in Survey Area 2: 34.50-R1 (September, 2016).

Photo 7. Muckets collected in Survey Area 2: 34.50-R1 (September, 2016)

Photo 8. Calipers displaying shell width of a mucket in Survey Area 2 (September 2016).

Photo 9. Wabash pigtoe *(Fusconaia flava)* mussels collected in Survey Area 1: 34.50-R2 (September, 2016).

Photo 10. Plain pocketbook mussel collected in Survey Area 1: 34.50-R2 (September, 2016).

Photo 11. Plain pocketbook collected in Survey Area 2 (September, 2016).

Photo 12. Calipers displaying shell width of a plain pocketbook collected during survey (September, 2016)

Photo 13. Spike *(Ellliptio dilatata)* mussel collected in Survey Area 2: 34.50-R1 (September, 2016).

Photo 14. Creeper *(Strophitus undulatus)* mussel collected in Survey Area 2: 34.50-R1 (September, 2016).

Photo 15. Fatmucket *(Lampsilis siliquoidea)* mussels collected in Survey Area 2: 34.50-R1 (September, 2016).

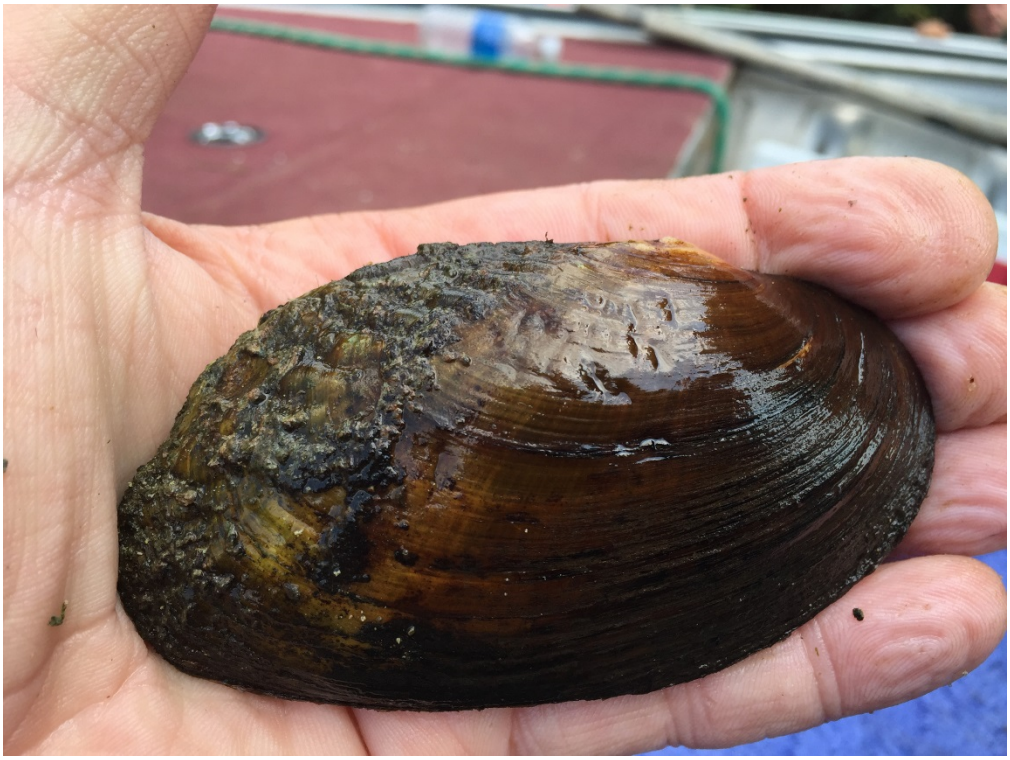

Photo 16. Fluted-shell *(Lasmigona costata)* mussel collected in Survey Area 2: 34.50-R1 (September, 2016).